Implementing a Holistic Approach to E-Learning Accessibility

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Abstract
The importance of accessibility to digital e-learning resources is widely acknowledged. The W3C WAI has played a leading role in promoting the importance of accessibility and developing guidelines which can help when developing accessible Web resources. The accessibility of e-learning resources provides additional challenges. In this paper the authors describe a holistic framework for addressing e-learning accessibility which takes into account the usability of e-learning, pedagogic issues and student learning styles in addition to technical and resource issues and provide a case study which illustrates use of this holistic approach to e-learning.

1 About This Paper

The importance of universal accessibility to Web resources is widely acknowledged. W3C's Web Accessibility Initiative (WAI) has developed guidelines which help to ensure that Web resources can be accessed by people with disabilities. With the Web providing the main delivery channel for e-learning resources it would appear that the WAI guidelines should be a requirement for e-learning development. This paper, however, puts the case for a wider perspective. There is a need to recognise the limitations of WAI guidelines and implementation. In addition there is a need to acknowledge that the IT sector has responded to demand for accessible digital resources by providing accessible versions of proprietary formats and operating systems. Finally there is a need to recognise that, just as IT has been used to provide accessible simulations of inaccessible real world learning, so too can accessible real world learning resources be used as a replacement for e-learning resources which may be inaccessible.

2 The Web Accessibility Initiative

The World Wide Web Consortium (W3C) (the body responsible for the coordination of developments to Web standards) established the Web Accessibility Initiative (WAI) with a remit to lead the Web to its full potential with a particular reference to promoting a high degree of accessibility for people with disabilities. WAI has successfully raised awareness of the importance of Web accessibility and in developing guidelines which help to ensure that Web resources are accessible, with the Web Content Accessibility Guidelines, often referred to as WCAG (WAI, 1999) being of particular relevance to developers of Web resources.

3 Challenges in Implementing WAI WCAG Guidelines

Background to Developments in the UK

In 2001 the UK Government introduced the Special Educational Needs and Disability Act (SENDA, 2001), bringing the previously excluded elements of the education sector within the remit of existing anti discrimination legislation. In the same year the JISC the (Joint Information Systems Committee) established the TechDis service with a remit for all aspects

of technology and disability within education. Since 2001 the service has been working with other intermediaries to try and understand the ramifications of the legislation on, amongst other things, e-learning.

An excellent overview of the legislation highlighting many of the issues that would be affected by the legislation is given in (Willder, 2002). However, she concludes that until the legislation is tested it will be difficult to draw conclusions. (Sloan, 2002) suggests that there is little doubt that e-learning will be within the scope of UK legislation:

> "… it can be seen that there is likely to be a duty on higher and further education institutions to ensure that their online teaching resources and VLEs are provided in a form accessible to disabled students. Further, institutions will be expected to make 'reasonable adjustments' to overcome these problems and are unlikely to be able to justify continuing discrimination."

Over a period of 4 years the authors have been working together with academic staff and individuals working in the policy area to better understand how standards and guidelines fit together with UK legislation and how that then transposes onto the learning experience of a disabled student in the UK. In working with learning technologists, disability staff and lecturers, the authors and others acknowledged in this paper have come to some interesting conclusions and challenges to those who are working in the field of accessibility.

This paper addresses some of these issues, discussing the work of standards organisations, exploring the nature of e-learning as both an isolated delivery method and a blended learning experience and how that can impact on disabled students. The paper concludes with a discussion of holistic approach developed with involvement by several of the academic organisations involved in supporting e-learning and disability.

Experiences of Implementing WAI WCAG Guidelines

Surveys of Compliance with WAI WCAG Guidelines

W3C WAI's success in developing accessibility guidelines has led to the need for tools which can be used to check for compliance with the guidelines. A variety of checking tools are now available, such as Bobby (Watchfire, n.d.) and The WAVE (Webaim, n.d.). Such tools have their limitations, as described by Ivory and Chevalier (Ivory, 2002) and Diaper and Worman (Diaper, 2003). However they do have a valuable role to play if used in conjunction with manual checking of the accessibility of Web resources.

A number of accessibility surveys have been carried out across the UK Higher Education community using an automated accessibility testing tool in order to profile the community and to gain an understanding of common accessibility problem areas.

A survey was carried out in August 2002 of the home page for over 160 UK University Web sites. The survey was carried out shortly before the SENDA legislation became law, which extended accessibility legislation to include the education sector. The survey revealed that about 57% of the pages failed to comply with WCAG 1.0 guidelines (Kelly, 2002).

The Disability Rights Commission (DRC) published a high profile report on the accessibility of 1,000 Web sites in the UK (DRC, 2004). The survey revealed that 81% of Web sites failed to meet minimum standards for disabled Web access. At a related press conference it was noted that sites highlighted by the DRC as exemplars of good practice actually failed to meet the minimum WAI standards, even though they were identified as Web sites which disabled users found usable.

Discussion of Findings

These findings seem depressing, particularly in light of the publicity given to the SENDA legislation across the community, the activities of support bodies such as TechDis and UKOLN and the level of awareness and support for WAI activities across the UK Higher Education sector.

The publication of the survey of the accessibility of UK University entry points led to interesting discussions on some of the difficulties of complying with the WAI WCAG guidelines and some concerns over the relevance of the guidelines. Areas of concern which have been raised are described by {Kelly, 2005b) and summarized in Table 1.

Table 1: WCAG Implementation Difficulties

Issue	Comments
Understanding and interpreting the guidelines	Guidelines can be difficult to understand and interpret consistently
Conflicts between accessibility and usability	Complying with accessibility guidelines may conflict with the Web site usability
Guidelines too theoretical:	Some guidelines are felt to be too theoretical, promoting format not yet been widely deployed or accepted within the marketplace
Use of proprietary solutions	There is a need to make use of proprietary formats which provide an effective solution to users' needs
Other IT developments	The guidelines address only Web standards and fail to acknowledge wider IT accessibility issues.

Although implementation of the WCAG guidelines may not always be easy, it should be acknowledged that the guidelines have been developed in good faith, and that implementation of the guidelines can help to make Web resources accessible. The over-ambitious nature of the guidelines has been observed in other areas: the initial version often seeks to address too many issues with subsequent versions having more realistic aims. It should be noted that WAI are currently developing WCAG 2.0 (WAI, 2004), which may address some of these concerns, but not necessarily the concerns of those involved in developing e-learning resources.

4 A Holistic Approach

The Need for a Holistic Approach

Much emphasis is now placed on accessibility in education; generally this has come to be synonymous with Web accessibility or the accessibility of e-learning. However to staff who are just starting out in educational development or using technology in a very iterative way with students the application of these standards and guidelines can be at best a discouragement or at worst damaging, preventing staff from exploring the potential of e-learning.

This approach also ignores a major facet of the educational experience: it is holistic. Students attend an institution and partake of a range of facilities and activities – some they will not relate to, others they will. Because a disabled student cannot access one type of assessment that happens to be delivered via a Web browser, it does not mean they cannot instead do an oral examination in a one-to-one situation. The current accessibility paradigm places emphasis on total online access, or if materials cannot be made accessible, then providing an equivalent online experience. This can be damaging to the educational experience of attending an institution, ignoring the fact that institutions and their staff deploy a range of learning methods, some of which will suit all students; others will not. The only way to judge the accessibility of an institution is to assess it holistically and not judge it by a single method of delivery.

The components of a proposed holistic framework to support the development of e-learning resources are outlined below.

Usability Issues

The Disability Rights Commission's report highlighted the importance of Web site usability for people with disabilities. The report pointed out that "45% of [the 585 accessibility and usability] problems were not a violation of any [WAI WCAG] Checkpoint and could therefore have been present on any WAI-conformant site regardless of rating". This point illustrates a limitation of the WAI WCAG guidelines. It should be self-evident that quality e-learning Web resources should be usable and not just accessible. However the strong emphasis given to accessibility, especially with concerns sometimes expressed that failure to comply with W3C WAI WCAG guidelines could lead to legal action, can lead to failure to give equal weight to usability issues.

Although it might appear desirable to include usability alongside accessibility there is a need to be aware of potential conflicts. This may be partly due to poor support for Web standards in browsers. In addition users may express preferences for e-learning resources which have conflict with accessibility guidelines. The proprietary Flash format is widely used for the development of interactive e-learning resources and on-line games. Such resources may be accessible. The RNIB (Royal National Institute for the Blind), for example, has encouraged the development of accessible Flash resources. The RNIB also provide advice on the development of accessible Flash resources (RNIB, n.d.). Although resources such as the RNIB Blind Date game may be usable and accessible, they would not appear to comply with the WAI WCAG guidelines as they make use of a proprietary file format.

Accessible e-Learning or Accessible Learning?

In the holistic approach to accessible e-learning there is a need to provide accessible **learning** experiences, and not necessarily an accessible **e-learning** experience. This approach has parallels with the concept of *blended learning* rather than the more limited *e-learning* approach.

As an example, consider an e-learning environment which provides a highly interactive 3D visualisation of a molecule. Such an environment is likely to be very difficult to make accessible to a visually impaired student or a student with impaired motor skills. Rather than seeking to develop an accessible version of such an environment (which, if possible to do, may prove costly, without any guarantee that the accessible equivalent will be usable by the student with disabilities). In such a case the teacher should consider the learning experience provided by the e-learning resources and seek to develop an alternative which provides an equivalent learning experience. In many cases it should be possible to find an acceptable

equivalent learning experience, such as the resources used prior to the development of the e-learning resource (for example, a physical representation of a molecule).

This approach may also be used when a real-world learning experience is not accessible. For example consider a field course for a geography student, which requires climbing a mountain or other terrain unsuited for a student in a wheelchair or with similar physical disabilities (this may include an overweight student or a heavy smoker who finds physical exertions difficult). A blinkered approach may seek to make the mountain accessible by using expensive all-terrain vehicles, building appropriate paths and ramps at key sites or, in the worst case scenario, cancelling the field trip for all students. A holistic approach allows the teacher to identify the learning experiences (such as the selection of appropriate sites to take water and soil samples) and seek equivalent learning experiences (perhaps providing the student with 3G phone technologies, videos, for use in selecting the sites, followed by discussion of the test results with other team members at base camp). This holistic approach to accessible learning has been accepted in a number of academic disciplines. For example the Virtual Field Course Web site (VFC, n.d.) describes several approaches to support field studies for students with disabilities.

Accessible Courses

This holistic approach encourages a more bird's eye view of the learning experience encountered by disabled students. The learning path that the student chooses to follow should be accessible while individual online components or learning objects may not. To provide another example consider a blind student who wishes to take a degree in biochemistry. When choosing a course the student should be advised on course modules which the student's disability may make it difficult for the student to pass (such as options which may require a student to peer through a microscope and describe what they see). Although such courses may not be possible for a blind student to take, the department could seek to provide accessible alternative course options which would still allow the student to be awarded a degree.

Adapting to Individual, Local, Political and Cultural Factors

The final components of the holistic framework for e-learning accessibility calls for an approach which takes into account individual needs and local cultural, political and social factors. Since accessibility is primarily about people and not about technologies the authors feel it is inappropriate to seek a universal solution. In seeking to provide accessible learning experiences it will be necessary to take into account the individual's specific needs, institutional factors, the subject discipline and the broader cultural and political factors.

Instead of aiming to provide an e-learning resource which is accessible to everyone this paper argues there can be advantages in providing resources which are tailored for the student's particular needs. An example of this approach is given in Section 5 of this paper.

The Holistic Framework

The holistic framework for e-learning accessibility, which has been described elsewhere (Kelly, 2005a) is illustrated in Figure 1.

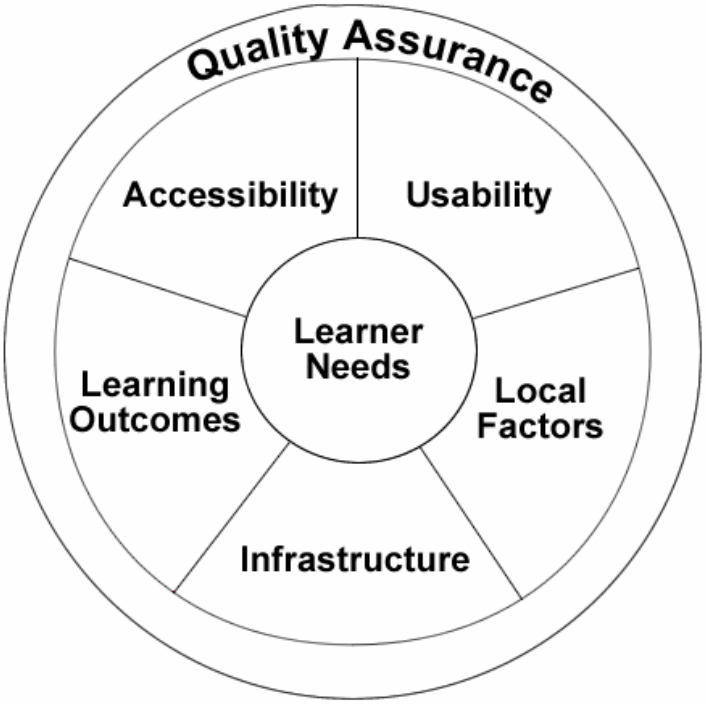

Figure 1: Holistic Framework for E-Learning Accessibility

Rather than relying purely on the WAI guidelines, the framework incorporates the guidelines as part of a broader approach to the provision of accessible e-learning resources. There is a need to address the usability of e-learning resources, the pedagogic aims of the e-learning resources, infrastructural and resources issues and to provide solutions which are appropriate to the needs of the framework. The authors feel that a quality assurance framework is needed to support this approach which will ensure that documented policies are provided and systematic procedures for ensuring compliance with the policies are implemented.

Discussion

It could be argued that this approach has limitations compared with the W3C WAI guidelines. The WAI guidelines can appear easier to implement as they provides a series of checklists. However a checklist approach can, in fact, be counter-productive as it encourages developers to prioritise the objective areas which testing tools can easily report on.

Another limitation of this approach may be its lack of universality which is implicit in its inclusion of institutional and local factors. This criticism may, in fact, be regarded in some quarters as strength of the approach, as it does not seek to mandate a single global solution, but rather welcomes diversity and a learner-centric approach to e-learning.

Whilst this work has been discussed and revised at length at various workshops and conferences, there is still a need to develop the framework and to provide examples of how it could be applied in a variety of circumstances, including differing learning environments, students with a variety of disabilities, use of various technologies and in a variety of different organisations.

5 i-Map: A Case Study

As discussed in this paper the ideal of an online education resource being ‘accessible to all’ is flawed, not just because different user needs require different approaches, but also because the content, format and pedagogy of every resource must be determined by the needs of its specific target audience. This is clearly illustrated when one considers the needs of people with sensory impairments accessing visual art online. Merely making the site accessible for

screen readers is pointless if the visual concepts they narrate are incomprehensible to a congenitally blind person. Equally, a high resolution video clip translating audio or text into British Sign Language will be wasted if, as may be the case, the very language of art is alien to that person. Considering an impairment generically will not make a site 'fully accessible' since variants of that impairment may alter the shape of the resource; the needs of one variant may run counter to the needs of another. In the field of visual impairment one must consider whether the target user is blind or partially sighted, do they have any visual memory, are they an adult or child, what experience or knowledge of art do they currently have and what are they hoping to achieve from use of the resource? Each combination of variables will require a different approach to ensure accessibility and no single resource can meet the access needs of all these variables.

i-Map (Howell, 2003) was developed for blind and partially sighted GCSE and A Level art pupils and their teachers. The aim of the project was to enable visually impaired students to critically and intellectually engage with the art of Matisse and Picasso, whilst providing their teachers with skills they could transfer to the study of other artists. The developers wanted i-Map to be a site that was not just technically accessible to these visually impaired users but also met their pedagogical needs. The developers were not concerned with the access needs of people with other impairments or with visually impaired people who had a sophisticated understanding of modern art.

The developers had no previous experience in this field and nor was there a clear precedent to follow. There was an early realisation that the accessibility guidelines provided only limited help when devising access to visual art on the Web. Testing the site with blind users showed that technical accessibility does not equate to intellectual accessibility. Guidelines alone do not provide access to artworks – an ALT tag merely names, not explains an image. Sighted people are barely aware of how much information is 'occularcentric'. The Tate Web site, for example, provides a vast range of texts and data about artworks and exhibitions that a blind user can technically navigate, but most of this information is intellectually inaccessible.

The original prototype attempted to meet the needs of both blind and partially sighted people in a single screen. Although functional, it was clumsy, overly complicated to use and meant that blind users had to contend with functions and content that applied only to partially sighted users and *vice versa*. As a result the site was split, with an animated version for partially sighted people, a text only version supported by raised drawings for people with no useful sight and a gateway that made explicit the intended users for each. When tested by a blind Web expert at the RNIB, no design faults were observed.

Every aspect of i-Map is designed to meet the specific needs of the targetted audience. Most obvious were the decisions concerning language. Firstly, the writing style took into account the difficulty of absorbing information delivered by a screen reader. A monotonous, deadpan voice that lacks cadence and emphasis needs sentence structures to be short and simple, while information must be delivered systematically, chronologically and incrementally if meaning is to be clear. This commitment to clarity also meant that i-Map's texts are very long, which suits visually impaired people who are used to listening attentively and prefer detailed explanations to hasty summations. Other examples include moving navigation links to the foot of the page to avoid endless repetition, having different methodologies of deconstruction tailored to the artwork in question, ensuring that careful attention to a detail was not immediately followed by a much wider view since dramatic leaps in scale are confusing, not removing ambiguity if that would alter the integrity of the artwork, but instead explaining how and why this was the artist's intension. Finally there was a need to contend with 'real life' demands such as maintaining continuity with the design of the Tate site as a whole, or

negotiating with sponsors for the removal of logos and strap lines in the body of the site so that textual continuity wasn't disrupted.

So although guidelines are essential for mapping out the landscape of Web accessibility, they can become problematic once content moves beyond basic information. Dedicated interpretation and education resources are by their nature exclusive, be they for primary school children with learning difficulties, families with a deaf member or congenitally blind artists.

6 The Need for a Holistic Approach

An article (Sitemorse, 2005) published by the accessibility auditing software company Sitemorse has generated heated debate over the relative merits of automated accessibility checking versus manual testing. The article describes the findings of an automated analysis carried out by Sitemorse across the Web sites of various disability organisations within the UK including the RNIB, RNID, the Disability Rights Commission, etc. The arguments over the relevance of the findings clearly demonstrates a lack of consensus and illustrates the difficulties that even national disability organisations find in complying with even basic WAI WCAG guidelines.

However the article failed to provide a solution to these conflicts. In this paper a framework has been described which does provide a resolution to this impasse. The framework is applicable to a learning context but is also well-suited to the provision of informational resources, such as those provided by disability organisations (who are targeting specific audiences) mentioned in the Sitemorse article.

7 Implementing Holistic Accessibility – Building on a Quality Assurance Framework

How might the holistic framework described in this paper be applied more widely to the development of e-learning resources? The JISC development programme funds a wide range of e-learning initiatives across the higher and further education sector. From 2002-2004 JISC funded the QA Focus project to develop a quality assurance (QA) framework which would help ensure wide accessibility and interoperability of project deliverables. The QA framework which was developed rejected the notion of formal compliance testing with standards as inappropriate for the JISC development community. Instead the framework requires projects to document their decisions on the standards and guidelines to be used and to implement systematic procedures to ensure these policy decisions were implemented correctly (Kelly *et al*, 2003).

The authors feel that this approach is well-suited to addressing the accessibility of project deliverables. In submissions projects could be expected to describe how they will ensure their project deliverables will be widely accessible, but not necessarily mandate compliance with a particular WAI WCAG compliance level or, alternatively, require compliance with, say, WAI WCAG A, but allow projects to explain non-compliance. It may be legitimate in certain circumstances (e.g. deliberate section of proprietary formats such as Flash to develop an e-learning resource) but not allowable in others (e.g. with information resources). An illustration of a template which could apply to future programme calls is illustrated below:

Purposes of project deliverables: Summarise the high-level purposes of project deliverables.
Policies on accessibility of project deliverables: State your policies on the accessibility of project deliverables.

Compliance checking procedures: Describes the procedures you will deploy which will ensure that the project deliverables comply with your policies.

Difficulties: Describe any difficulties you envisage in implementing your policies.

Strategies for addressing deliverables: Describe possible approaches for addressing the difficulties.

Figure 2: Proposed Template

We can see how this could be applied from an example described at a conference in which a speaker described a range of applications of Web technologies within a public library setting. The example of providing an online game developed using Flash was given. In response to a question concerning the accessibility of the game, the speaker responded that, although the game had proved popular, it would probably have to be removed once accessibility legislation became law. In response to a question about the purpose of the game, it emerged that the high-level purpose was to entertain children while their parents browse books in the library. Applying the holistic framework it can be seen that rather than seeking to develop an accessible version of the game, it would be perfectly legitimate to provide an alternative such as building blocks or a bouncy castle to entertain the children. This would have the additional benefit in not having to treat children who could not use Flash due to their disabilities in a special fashion; rather this approach provides an alterative resource for all children.

8 Conclusions

This paper argues that although the W3C WAI guidelines for content accessibility are valuable, they should not be regarded as the only set of criteria which developers of e-learning resources need to consider. Not only is there a need to address a wider set of issues than those addressed in the WAI guidelines, there are also other factors which need to be addressed, some of which may conflict with WAI guidelines. In addition there is a need to place the learner at the centre of development process. This approach focuses on the broad learning outcomes and recognises that inaccessible e-learning resources may be deployed provided that disabled learners are still able to demonstrate the required learning outcomes in a way that does not disadvantage them or their non-disabled peers.

The authors acknowledge that, in some quarters, these ideas made be regarded as controversial, especially in organisations which have defined e-learning accessibility policies solely using the WAI guidelines. It is also recognised that there is still an on-going debate to be held. The authors welcome comments and input to this debate.

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